The Distinct Trajectories of Black and White Students with Identical Achievement[*]

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Preliminary draft; more results to be added.

Abstract

We bring new data to the longstanding achievement gap between Black and white children in the United States. Constructing a panel of nearly half a million children tracked from kindergarten through age 30, we first highlight the stark differences in test scores between Black and white students, particularly at the extremes. In the lowest achieving one percent of all test takers, for example, Black students outnumber white students three-to-one. In the top one percent, white students outnumber Black students fifty-to-one. We then compare the outcomes of students with the same test scores, which provides useful context for other racial disparities in the United States. We show, for example, that Black students with high levels of achievement are substantially less likely than White students with the same scores to be in gifted programs. At the same time, Black students with low test scores are substantially less likely to be in special education programs. We show that Black students with low test scores, and only Black students with low test scores, are more likely than their white counterparts to drop out of high school. Across the distribution of achievement, Black students, relative to white students with the same achievement, are nonetheless more likely to enroll in college. However, they are still significantly less likely to complete a college degree of any kind. We also show that Black students, at any given level of achievement, which is often regarded as a level of skill, earn substantially lower wages than their white counterparts, nearly $10,000 less annually, a gap that bears almost exclusively on Black men. None of these disparities conditional on test scores, can be fully explained, or even mostly explained, by schools: Substantial differences exist between Black and white students who obtained the same scores while attending the same schools.

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Introduction

A concerning yet enduring feature of the educational system in the United States is a substantial "achievement gap" between Black and white students. This gap, defined by test scores, emerges early in school and persists throughout students' academic lives (e.g., Fryer Jr and Levitt, 2004; Fryer and Levitt, 2006; Card and Rothstein, 2007; Vigdor and Ludwig, 2008; Clotfelter, Ladd and Vigdor, 2009). The gap, long regarded as a skill gap, portends poor outcomes for Black people relative to their white counterparts, and indeed educational attainment, employment status, earnings, and a host of other socioeconomic markers follow similar troubling patterns. The gap has rightfully drawn the attention of policymakers and researchers for as long as Black children have been allowed to attend the same schools as white children (Coleman et al., 1966). Yet, some of the best available data to study the achievement gap, with all it encompasses about racial inequality in the United States, have not been thoroughly parsed.

This paper examines the Black-white achievement gap with confidential data that cover a large number of people, span many years, and include a wide variety of outcomes. Specifically, we build a panel of about 400,000 Black and white students tracked from elementary school, through post-secondary education, and into the labor market using administrative records from the State of Texas, home to more Black people than any state in the country. The depth and breadth of these data offer new insights into the nature and extent of racial disparity in the United States, which we begin to document here.

This paper first describes, in detail, the differences in test scores between Black and white students. The focus of previous work has been on average scores. In line with this literature, we find a large achievement gap between Black and white students, which does not improve as students age and has not improved in the last thirty years. Advancing the literature, we show the entire distribution of standardized test scores, revealing stark differences across the range of achievement, especially in the tails. Among all test takers in Texas, the single most common percentile for Black students is the bottom one percent; for white students, it is the

top one percent. As a leading indicator, the average achievement gap has long foreshadowed worse outcomes for Black people. These differences in the tails highlight the extreme inequality that underlie worse outcomes.

This paper then takes a different approach toward better understanding the achievement gap and what it means for other racial disparities. Rather than compare the test scores of Black and white students, as the literature has frequently done, we compare the outcomes of Black and white students with identical levels of achievement. Specifically, we ask, among students with the same scores on the same tests, how much less likely or more likely are Black students to be in gifted programs, to complete college, or to earn high wages, among other vital indications of success. As is well known, along all these measures, Black people generally fare worse than white people, but conditioning on test scores reveals information that may change certain narratives about racial inequality.

We show that Black students are more likely than white students with the same test scores to ever be enrolled in a gifted program. They are far less likely, however, to be enrolled consistently in gifted programs (i.e., in most rather than just one grade level) conditional on test scores. Even Black students with nearly perfect standardized test scores are about half as likely as white students with the same excellent scores to be enrolled in many grade levels. At the other end of spectrum, Black students performing poorly on standardized tests are significantly less likely than white students with the same low scores to be enrolled in special education programs for any length of time, about one fourth as likely. Given that the programs screen on measures of aptitude, these wide discrepancies in gifted and special education programs point to significant issues with access to resources, resources that are expressly intended for students in the tails of the skill distribution.

We also show that Black students with low test scores are much more likely than their white counterparts to drop out of high school. Black students with higher test scores are just as likely as high-performing white students to complete high school. Black students, especially those with low test scores, are nonetheless more likely to enroll in a college of any kind. However, at all levels of achievement and particularly at the highest levels of

achievement, Black students are less likely to complete the degrees they pursue. The fact that Black students, conditional on test scores, are trying more frequently to obtain college degrees yet succeeding less frequently is important context for discussions of the racial attainment gap. It suggests that neither demand for college nor preparedness for college fully explains the racial attainment gap. Other difficulties, possibly financial ones, are preventing Black students from completing their degrees.

We also show that Black students, no matter their standing in terms of test scores, face large gaps in earnings relative to white students with the same standing. The gap, whether at the tenth percentile or the ninetieth, is close to $10,000 annually, much larger than what would be anticipated from the observed gap in educational attainment. The gap is so large that, over a typical career, it is approximately equal to the current wealth gap between Black and white Americans. We show further, however, that this gap is driven almost solely by Black men. Black women reach earnings similar to (although still lower than) white women with the same achievement. The dichotomy invites questions of incarceration and the likelihood of being raised by a single parent, which has been associated with poor long-run outcomes particularly among men (Chetty et al., 2020). However, upon linking in administrative conviction data and vital records from Texas, we find that almost all of the male gap persists when we filter our sample to students who have never been convicted of a crime or to students for whom a father was not listed on the birth certificate. No matter the difference by sex, the fact that many Black people earn much less than their similarly achieving white counterparts limits hope that closing the achievement gap would close the vast and stubborn earnings gap in the United States.

Critically, all the gaps revealed in this paper persist within schools. That is, when we compare students with the same test-score rank not statewide but within their high school, we obtain similar differentials at each rank, albeit smaller. This is true even if we consider elementary schools, which often capture neighborhoods at a very fine scale. The implication is that Black students with a given test score tend to fare worse than white students with the same achievement at the same school. It is not the case, for instance, that certain schools—

perhaps large, urban schools serving many minority students where test scores may be typical but resources are scarcer—are driving the disparities we observe. The vast majority of Black public-school students attend schools with many white people, and the gaps exist in those places in similar magnitude.

Another reasonable explanation for these findings is that Black students, even after controlling for test scores (and school), experience disadvantages that white students do not. Black students with a certain test score may, for instance, have less family wealth or poorer personal health than white students with the same test score, and those factors may drive the differences we observe. If so, one might expect that, for a given level of achievement, Black students demonstrate lower attendance, a widely accepted indicator of non-cognitive skills. We show that the opposite is true. In our final result, Black students, conditional on test scores, are actually significantly less likely to be absent from school on a given school day. Indeed, Black students receive far less tailored instruction, accrue fewer degrees, and earn much lower wages, even though a basic barometer for student success appears better.

This paper explains each of these findings in much greater detail and outlines their contributions to the literature. We start, however, with a description of the data source that enables their creation. We close with a brief discussion of their policy implications.

Data

The core of the data we use is administrative educational records from all public schools in the State of Texas, the second largest state in the United States in terms of population and the largest in terms of Black population.[1] The records date back to the early 1990s, and they contain a unique student identifier, such that any given student can be tracked year after year. The records include standardized test scores, absences, and other educational outcomes, in addition to demographic and geographic information. They indicate high school completion

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[1] Texas also has a high share of children attending public school at close to 90 percent. Only five states have a higher percentage of students attending public rather than private school.

and have been linked to college enrollment and graduation records whether within or outside of Texas. The students in the data have even been linked to unemployment insurance records from the State of Texas, giving a measure of earnings. Although not part of the standard suite of information, we have further linked conviction data and vital records from Texas for reasons that will become clear as we progress. Collectively, these linkages give primary education, secondary education, post-secondary education, and labor-market outcomes in a single repository for millions of students over multiple decades. No other data source can match such large sample size, long period of observation, and variety of outcomes, while maintaining a longitudinal nature.

We leverage these features in constructing a panel of approximately 85,000 Black and 303,000 white students, all non-Hispanic, who can be followed from third grade through age 30, when education is almost always complete and wage profiles begin to stabilize.[2] Consequently, our cohorts of interest are students born between 1986 and 1991. Our analysis considers outcomes in several different periods of life for individuals in these cohorts. To avoid comparing different sets of people as we progress through those outcomes, we "balance" the panel. That is, we keep only the students who appear consistently over time in our data. To be in the sample, students may be missing in only one or zero grades between the third and twelfth grades. They need not be in the college enrollment data because not all students attend college, but they must be present in the earnings data for at least four years. These restrictions exclude many students from the sample, but also include many students. According to the American Community Survey, nearly 80 percent of children born in Texas still live in Texas at age 30, the highest such rate of any state by a wide margin.[3]

The implications of such a dataset are manifold, but we emphasize two key features. First, a large sample size allows for a clear picture of the entire distribution of test scores, which is the starting point of the next section. The sample size is so large that we can split the distri-

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[2] While not the focus of this paper, we show some results for Hispanic students and present them in Appendix Figure A8. Consult the discussion co-located with that figure for more detail.

[3] Perhaps most importantly, although not shown, all results in this paper are qualitatively similar if we were to instead use the unbalanced panel (i.e., the students who appear in just a couple of grade levels).

bution into many pieces (percentiles) and compare, with precision, the traits and outcomes of Black and white students within a single small piece. Effectively then, we can visually compare students with nearly identical test scores, for any given test score. That procedure forms the remainder of the section to follow. Second, as we compare Black and white students with the same academic performance, the large set of outcomes permits study across the critical developmental periods of adolescence and young adulthood. While several panel studies follow students through high school (and while several states have educational data infrastructure), it is exceedingly rare that they are tracked into college and even rarer that they are linked to earnings.

The data sources we use have been used for many years by other researchers to better understand a wide array of topics related to education. That research includes critical work on the Black-white achievement gap (e.g., Hanushek and Rivkin, 2009). However, a study of race and achievement that spans the entire adolescent and young adult lives of hundreds of thousands of Black and white Americans is unique to this inquiry.

Results

The Achievement Gap

We begin with an analysis of test scores, or achievement. Here and throughout, we focus on standardized test scores in mathematics, which are mandated for all public school students in Texas at most grade levels, beginning with the third grade. Although we focus on mathematics, none of the results in this paper change appreciably if we instead consider reading, the other subject mandated at nearly every grade level. We standardize test scores in each grade (and cohort) by expressing them as z-scores, a measure of dispersion around the average test score when the average test score is normalized to zero. The z-scores are based on all test takers, not just those who are Black or white. We then average the z-scores for a

given student across all grade levels.[4] Summarily, achievement of -0.10 indicates a student whose test scores in mathematics, when averaged across all grade levels, were 10 percent of a standard deviation below the average for everyone, regardless of race or ethnicity.

In our sample, the average z-score among Black students is about -0.30. For white students, it is about 0.40. This gives an achievement gap of 0.70, or 70 percent of a standard deviation, which is substantial. Many of the largest randomized interventions aimed at raising student achievement, such as drastic reductions in class size, improve test score by only 10 to 22 percent of a standard deviation (Hanushek, 1999; Schanzenbach, 2006). Yet, 0.70 is not surprising; it is similar to what has been measured in other settings in existing studies (e.g., Barton and Coley, 2010). If we examine each grade level separately, the gap widens only slightly as students age, from 0.65 in the third grade to 0.75 in the eleventh grade, which is also consistent with the literature (Barton and Coley, 2010). If we look beyond the cohorts in our sample, the Black-white achievement gap has changed little since 1992, when our data begin more than 30 years ago. There is less precedence for this finding, but it has support as well (Reardon, 2021).

What these gaps, however striking, mask is the distribution of test scores. They miss the likelihood of Black students reaching a certain level of achievement relative white students. One primary contribution here is to be clear about just how likely Black students are to see poor results and how unlikely they are to see good results relative to white students, particularly at the extremes of poor and good. For detecting serious problems, such as a learning disability, or predicting popular notions of success, such as admission to an Ivy League school,

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[4] We average across all grades in order to reduce noise in creating a measure of "skill." We note, however, that almost every gap to follow is larger (often much larger) if we were to restrict attention to standardized tests taken during elementary school rather than through high school. (See Appendix Figure A7 for more detail.) Upon request, we can provide extensive detail on the persistence of rank in test scores for Black and white students as they progress through school. Recently, an excellent paper was published, Austin et al. (2023), devoted to this concept of "academic mobility," so we cut most of that analysis from our inquiry. We refer readers interested in students' ability to rise or fall in the test-score distribution (and how it differs by their demographics) to their work. To briefly summarize our results nonetheless, as shown in Appendix Figure A1, we find that Black students tend to be downwardly mobile while white students tend to be upwardly mobile.

Figure 1: THE DISTRIBUTION OF ACHIEVEMENT
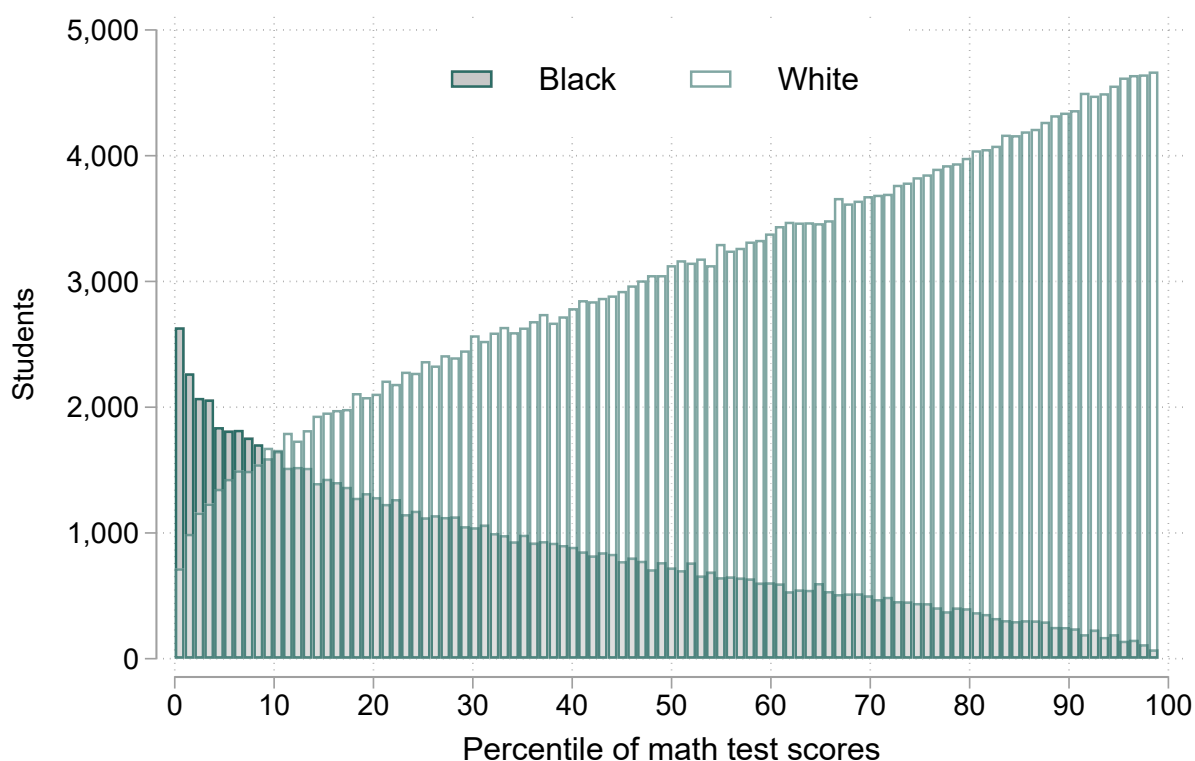
Notes: This figure shows the number of students, Black or white, who score in each percentile of the math test-score distribution. Percentiles are based on all test takers in Texas public schools, regardless of race or ethnicity, and percentiles are generated from z-scores (standardized within grade and cohort) averaged across all grades in which tests are mandated. The data come from the Texas Education Research Center, using birth cohorts 1986 through 1991.

these "tails" are much more relevant measures than the averages typically reported.[5] More broadly, the distribution contains more information than averages, which can be deceiving.

Figure 1 shows the distribution of test scores in our sample. Specifically, we plot the number of Black students and white students, separately, in each percentile of the distribution of test scores, where the distribution and thus its percentiles pool all students no matter race or ethnicity. We index the bottom one percent, the lowest achieving students in the entire public school system in Texas, as the "zeroth" percentile and the top one percent, the highest achieving students in Texas, as the 99th.

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[5] Karna et al. (2025) provides an interesting treatment of achievement at the top, of "excellence," by race.

From the large literature on achievement gaps and from what we have already documented here, the fact that Black students are more concentrated than white students at lower test scores is not at all surprising, but the extent of the discrepancies that we lay bare in Figure 1 is striking. The single most common percentile of achievement for Black students is the zeroth percentile. For white students, it is the 99th. The ratio of white students to Black students in the sample overall is four-to-one. Yet, in the bottom percentile of test scores, Black students instead outnumber white students three-to-one. In the top percentile, white students outnumber Black students fifty-to-one. There are 85,000 Black students in the sample. Fewer than 75 are in the top percentile of achievement. Close to half of all Black students fall in the bottom fifth, while close to half of all white students fall in the top fifth.

It is not the case that the masses in each percentile follow mechanically from the reported achievement gap between Black and white students of 0.70 standard deviations. One reason is that the underlying distribution includes all students, not just Black and white students. It includes Hispanic students, who now comprise more than half of all public school students in Texas. Their test scores are, on average, below white students but above Black students. This is true not just in mathematics but in reading. It also includes Asian students, who comprise a modest share of students but have very high test scores in both subjects.[6] If we were to instead pool only Black and white students, these distributional differences would still depend on more than the average gap. They would require assumptions about the distribution for each race. They might require, for instance, that the distributions are normally distributed with the same variance (i.e., that the test scores of Black students are only shifted left). Those particular assumptions, while not strictly true of the data, are decent approximations. But even so, the numbers we report here serve as a poignant reminder of just how unequal an achievement gap of 0.70 standard deviations is.

Like the differences in the averages, these racial disparities in the tails do not improve as

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[6] The outcomes of Hispanic and Asian students are interesting in their own right. Information regarding Hispanic outcomes are included in Appendix Figure A8, where that population's conditional gaps (relative to white students) are compared with the conditional gaps of Black students discussed in the main body of this paper.

students age. The ratios of Black students to white students in the zeroth and 99th percentiles, for instance, actually grow slightly more imbalanced with subsequent grade levels. These ratios have also not improved over time. Even among students who recently exited high school, the ratios are nearly identical. This is true despite an overhaul of the testing regime in Texas in 2012, which was partially intended to help low-performing students meet higher standards.

Test scores, because they reflect skills, are in many ways a leading indicator. They are known at young ages, yet predict critical outcomes at much older ones. As such, the well documented achievement, on average, has long foreshadowed poor outcomes for Black people in the United States. The differences in the tails that we document foreshadow the grave inequality driving those worse outcomes. The fact that neither the average nor the tails are improving over time suggests that poor outcomes for Black Americans could extend far into the future. As the importance of skills in the modern economy grows, the lack of progress becomes even more problematic (Murnane, Willett and Levy, 1995).

Other Racial Gaps Conditional on Achievement

In the remainder of our analysis, we consider other prominent racial gaps. We no longer compare the test scores of Black and white students. Rather, we compare the outcomes of Black and white students with the same test scores. As we did in Figure 1, we will categorize students according to their percentile of achievement, where percentiles again reflect all test takers statewide. While Figure 1 showed the number of Black and white students in each percentile, the figures to follow plot an outcome, such as high school graduation, separately for Black and white students in each percentile. In effect, we close the achievement gap and examine the extent to which other gaps persist. Several insights emerge.

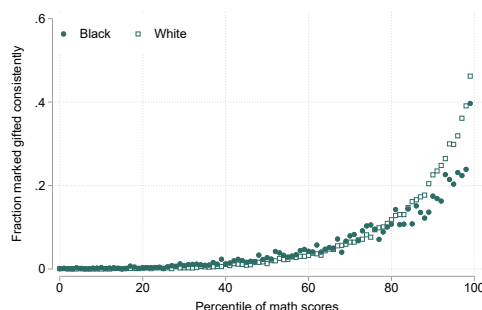### Gifted and Special Education Programs

We first consider tailored instruction, namely gifted and special education programs. It is known that Black students are much less likely than white students to be in either of these

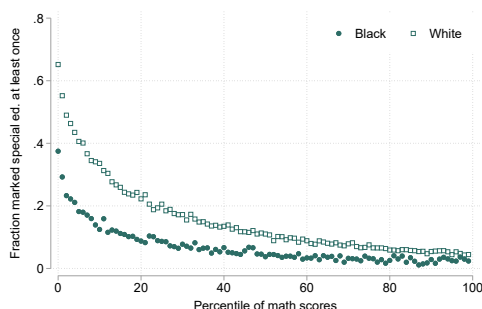# Figure 2: TAILORED INSTRUCTION CONDITIONAL ON ACHIEVEMENT
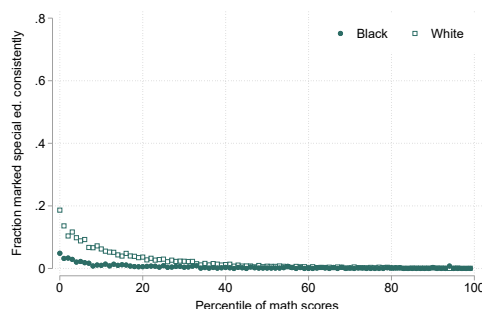
(a) ENROLLED IN A GIFTED PROGRAM AT LEAST ONCE
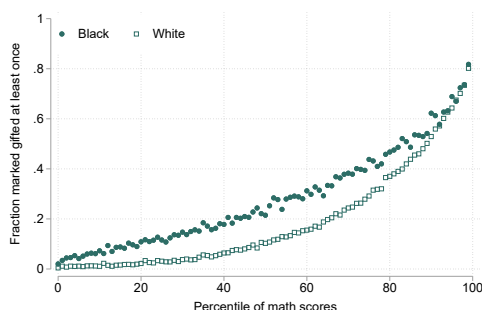
(b) ENROLLED IN A GIFTED PROGRAM MANY YEARS

(c) ENROLLED IN SPECIAL EDUCATION AT LEAST ONCE

(d) ENROLLED IN SPECIAL EDUCATION MANY YEARS

Notes: This figure shows the likelihood of students, Black or white, in each percentile of the math test-score distribution to receive tailored instruction. Panel A plots the likelihood of enrollment in a gifted program at any point; Panel B plots the likelihood of enrollment in gifted programs in at least half of the grade levels between 3rd grade (when standardized testing in math begins) and 12th grade. Panels C and D do the same for special education. Percentiles are based on all test takers in Texas public schools, regardless of race or ethnicity, and percentiles are generated from z-scores (standardized within grade and cohort) averaged across all grades in which tests are mandated. The data come from the Texas Education Research Center, using birth cohorts 1986 through 1991.

programs. In our data, for instance, white students are about twice as likely to be in a gifted program in eleventh grade (about 16 percent versus 8 percent). What is unknown is whether these gaps persist when controlling for a measure of need like test scores. One might expect that, between two students with the same test score, their likelihoods of enrollment would be similar given that gifted and special education screen on measures of aptitude. In Figure 2, we show that this is not the case.

Black students, as shown in Panel A of Figure 2, are actually much more likely than white students with the same test scores to ever be enrolled in a gifted program.[7] However, as shown Panel B of Figure 2, they are much less likely to be enrolled consistently in gifted programs, where consistency is defined as more than half of the grades between third and twelfth. In the top twenty percentiles, which account for the lion's share of all enrollment, Black students are substantially less likely than their white counterparts to maintain gifted status. About 20 percent of the Black students compared to 30 percent of the white students in the 95th percentile of achievement are consistently enrolled in gifted programs, a 50 percent difference in their likelihoods. In Panels C and D of Figure 2, we show the analogous information for special education programs. Conditional on test scores, Black students performing poorly on standardized tests are significantly less likely than white students to be enrolled in special education programs. Unlike gifted programs, this is true whether we consider any enrollment, as in Panel C, or consistent enrollment, as in Panel D. The access gap in special education is wide. In the bottom twenty percentiles of achievement, which account for nearly all students consistently enrolled in special education programs, Black students are about one fourth as likely as their white students with the same test scores to receive intervention.

These discrepancies, in both gifted and special education programs, are driven mostly by Black students being enrolled at younger ages (in elementary school) but not at older ages (in high school), rather than Black students joining the programs at older ages. For gifted programs, the failure to sustain enrollment is driven partially by the failure of Black students, relative to white similarly achieving students, to sustain their high test scores. For instance, Black students in the top fifth of test scores in elementary school are nearly half as likely to remain in the top fifth in high school, about 34 percent versus 60 percent. However, many

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[7] It is useful to note that, although Black students at every percentile of achievement are at least as likely as white students in the same percentile to ever be enrolled in a gifted program, they are still less likely to ever be enrolled on average. As with the remaining figures in this paper, it is important to remember that Black students, as shown in Figure 1, are concentrated at lower test scores, where outcomes are worse. In other words, the group average for Black students places greater weight on worse outcomes; for white students, on better outcomes.

Black students who sustain their excellent test scores eventually cease enrollment, typically in middle school. The picture for special education is murkier because many students in these programs will stop taking the standardized exams we study, but it is not the case that low-achieving Black students are more likely than their white counterparts to improve. To the contrary, Black students are disproportionately likely remain at the low end of achievement.[8]

These findings about tailored instruction contribute directly to a literature on racial inequality in "tracking" (e.g., Archbald, Glutting and Qian, 2009; Francis and Darity, 2021). These papers compare participation in advanced courses between Black and white with similar academic qualifications. Summarizing the work, Archbald, Glutting and Qian (2009) writes, "Overall, the number of studies remains relatively small with mixed findings, although the preponderance of evidence indicates that prior achievement in most cases accounts for racial disproportionality in track placement." We provide clear evidence that prior achievement does *not* account for the racial difference in two broad forms of tracking, gifted and special education programs. This is true even though there is evidence that Black students benefit the most from such programs (Cohodes, 2020).

A natural question that will arise for all the gaps we consider is whether schools can "explain" them. Here, are Black students less likely to receive tailored instruction than equally performing white students *in the same school*? In principle, the disparity we observe, for instance in Figure 2B (consistent enrollment in gifted programs), could be driven by high-performing Black students attending schools with fewer or smaller gifted and special education programs. In Appendix Figure A2, we show that this is not the case; the gaps persist within schools. We replicate Figure 2, but we rank students within their high school rather than statewide, and we de-mean the enrollment rates by the high school's overall rate (for all students regardless of race or ethnicity). These adjustment—which one could view as a fixed effect for high school—means that a vertical distance is the difference in the likelihood of Black and white students with the same rank in their high school being in a certain pro-

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[8]   Again, we refer to Austin et al. (2023) provide a devoted treatment of academic mobility.

gram adjusting for their high school's general propensity to enroll students.[9] The gap for ever being enrolled in a gifted program dissipates (Panel A), but the other gaps remain, and they remain in similar magnitudes. Consistent enrollment in gifted programs (Panel B) and special education programs (Panel D) fall by about 25 percent. That is, school can account for only a modest fraction of the disparity between Black and white students with identical achievement. We emphasize here and throughout, however, that, even if schools were to fully "explain" a gap, the fact would remain that Black students attend the culpable schools and live with the ramifications.

Educational Attainment

Next, we consider educational attainment. Our data includes flags for high school completion. For the cohorts in our sample, 1986 through 1991, our data also has linkages to colleges and universities nationwide. This post-secondary information includes both enrollment and graduation records, meaning we observe attempts to attain higher degrees, not just the attainment of higher degrees. Figure 3 shows rates of high school completion, college enrollment, and college completion, where the latter two reflect all colleges and universities, whether two-year, four-year, or graduate degree programs.

The rates in Figure 3 are higher than one might expect to see based on survey information from other sources. This is because we use a balanced panel of students. As discussed in the previous section, we drop students who are not present in multiple years of primary and secondary education (so that all of the outcomes in this paper are derived from the same set of students). Thus, our high school completion rate, for example, is specifically a measure of drop out in twelfth grade, which is much lower than overall drop-out rates. Similarly, rates of college going and graduating reflect those of individuals who complete at least eleventh grade. When conditioning on completion of eleventh grade (and cohort), our rates are similar to what can be found in a survey like the American Community Survey. It is well known from

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[9] In Appendix Figure A6, we present the average conditional gap across the distribution for all outcomes included in this paper, along with several others.

Figure 3: EDUCATIONAL ATTAINMENT CONDITIONAL ON ACHIEVEMENT
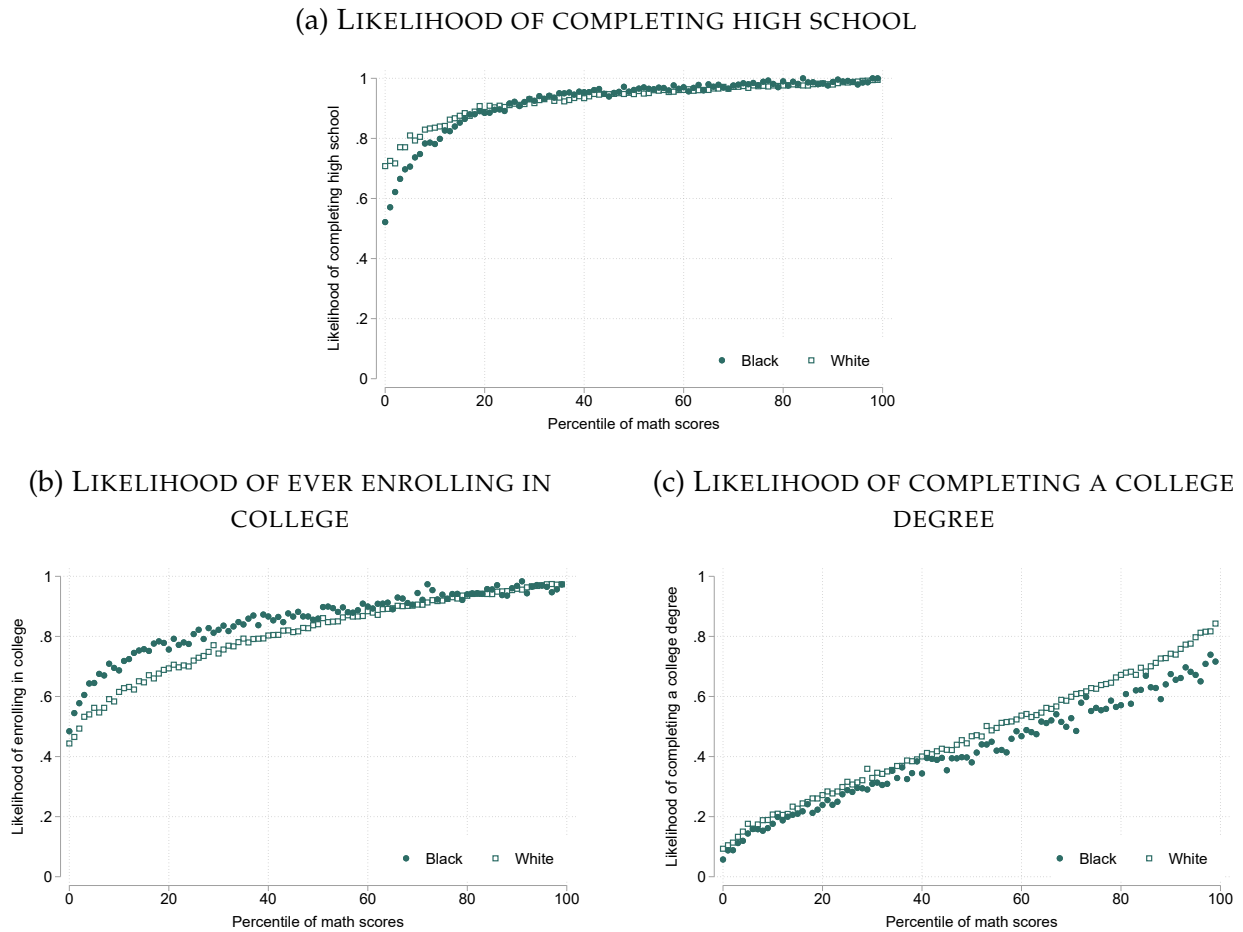
(a) LIKELIHOOD OF COMPLETING HIGH SCHOOL

(b) LIKELIHOOD OF EVER ENROLLING IN COLLEGE

(c) LIKELIHOOD OF COMPLETING A COLLEGE DEGREE

Notes: This figure shows the likelihood of students, Black or white, in each percentile of the math test-score distribution reaching a certain level of education. Panel A plots the likelihood of completing high school; Panel B plots the likelihood of attending some college; and Panel C plots the likelihood of completing a college degree. Percentiles are based on all test takers in Texas public schools, regardless of race or ethnicity, and percentiles are generated from z-scores (standardized within grade and cohort) averaged across all grades in which tests are mandated. The data come from the Texas Education Research Center, using birth cohorts 1986 through 1991.

those surveys that Black people have lower educational attainment than white people at all levels of education. In our sample, white students are about 70 percent more likely to obtain a college degree (of any kind by age 30) than Black students. Our goal is to understand the racial gap in educational attainment among similarly achieving individuals.

As shown in Panel A of Figure 3, Black students at all but the bottom fifth of the test score

distribution are just as likely as similarly achieving white students to complete high school. In the bottom fifth, Black students are significantly more likely to drop out. In the zeroth percentile, they are nearly twice as likely to drop out, with graduation rate of just over 50 percent compared just over 70 percent for white students. Despite their disadvantage in high school completion, across most of the test score distribution and particularly at the bottom of the distribution, Black students are nonetheless more likely than their white counterparts to enroll in college of any kind. This is shown in Panel B of Figure 3. At the 20th percentile, for example, Black students are about 10 percentage points more likely to enroll at a post-secondary institution (about 80 percent versus 70 percent). Despite their higher propensity to enroll in college, Black people, however, are also significantly less likely to complete a degree of any kind, even at the highest levels of achievement. This is shown in Panel C of Figure 3. In the 99th percentile, Black students are almost 10 percentage points less likely to complete a degree. Moving down in achievement, the gap shrinks in percentage points but remain wide in percentage terms, coincidentally about 10 percent lower. Again, these differences in college completion exist despite Black students, conditional on test scores, having higher rates of college enrollment. They exist despite Black students being disproportionately likely to enroll in two-year rather than four-year programs and despite Black students, even among students attending four-year institutions, applying to and attending less selective universities (Black, Cortes and Lincove, 2020).

Past papers, although their results have received too little recognition, have found that Black students tend to have more years of education than white students with similar skills, where skills are typically measured with performance on the Armed Forces Qualification Test, or AFQT (Lang and Manove, 2011). We cannot assess years of education directly in our data, but our results very likely agree with the result in these papers. This is because college enrollment rates are so much higher in the portion of the achievement distribution where many Black students reside. The result supports the notion that financial constraints, not just preparedness and willingness, are particularly important barriers to college degree attainment for Black students. Our conclusions, however, depart from the literature, albeit

a small literature, in important ways. Our result that Black students, conditional on test scores, are less likely to complete high school stands in contrast to the result from Rivkin (1995), who finds that they are more likely to, according to data from the High School and Beyond Longitudinal Survey. Our result that college enrollment, controlling for achievement, is higher among Black students is consistent with Cameron and Heckman (2001), but we provide additional information. We show that college graduation specifically is lower, which is useful knowledge given the importance of degrees of education over years of education (i.e., "sheepskin" effects).[10] Relative to all existing work, we also show precisely which parts of the achievement distribution are driving racial disparities in educational attainment.

In Appendix Figure A3, we show that these gaps in educational attainment conditional on test scores are present within schools. As before (as in Appendix Figure A2), we rank students within their high schools and remove their high school's propensity for each level of attainment. The disparities for each level of attainment and at each rank are similar. One exception is high school completion, where high ranking Black students are more likely than their white classmates to graduate. Another small but noteworthy exception is the very highest achieving Black students (the top two percentiles) in terms of college graduation. Among high school peers, these exceptional students appear to "catch up" to their white counterparts, demonstrating that there are instances in which disadvantages can close and even reverse.

Earnings

Finally, we consider earnings. Earnings are derived from unemployment records from the State of Texas. Because we observe earnings only within the state, it is important to reiterate that the sample excludes students (Black or white) who move away from Texas (at any age) and that such moves are rare in Texas, with nearly 80 percent of all children born in the

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[10] Arcidiacono and Koedel (2014) find that "preentry skills," such as high school GPA, can explain a large share the Black-white gap in college completion. Our results are qualitatively consistent with their conclusion. Although not immediately discernible from the figures in this paper, the overall difference in college completion can be accounted for largely by differences in test scores rather than different "returns" to test scores by race.

state still residing their in early adulthood. In calculating earnings, we count unemployment as zero earnings. We define unemployment as having no reported earnings for up to three consecutive quarters. If four or more quarters are missing, we assume the individual moved away or is pursuing higher education. The threshold of three is chosen because longer unemployment spells are rare and, when we choose three, the age-specific unemployment rates match other data sources, such as the Current Population Survey. We take the average of annualized earnings between ages 27 and 28 (in order to avoid COVID-affected labor markets for all cohorts), but the results to follow are qualitatively similar if we consider other age ranges.

As a large literature has made clear, Black people earn less than white people (e.g., Bayer and Charles, 2018). According to the American Community Survey, Black people born in Texas in the years we study (1986 through 1991) earn, on average, about 40 percent less. The discrepancy shrinks but persists, as is seen in other contexts, when controlling for education, occupation, and other observable characteristics of working-age individuals. In Figure 4, we show earnings controlling for test scores and the skills that they capture.

As shown in Figure 4, Black individuals, regardless of achievement, face substantial gaps in earnings relative to similarly achieving white individuals. The gap, across the entire distribution of test score, is close to $10,000 annually. For perspective, the average annual earnings among Black people in our sample is about $17,000. The gap in Figure 4 is much larger than one would expect based purely on the disparity in educational attainment that we have already documented. For instance, the college wage premium, which white students are more likely to receive at any level achievement (Panel C of Figure 3), can explain less than 10 percent of the $10,000 difference. The fact that Black students are more likely to have some college (Panel B of Figure 3) implies the explanatory power of educational attainment is even less. The gap, at all percentiles, is explained almost evenly by higher rates of unemployment and lower wages among those who are employed, even at the bottom of the achievement

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Figure 4: EARNINGS CONDITIONAL ON ACHIEVEMENT
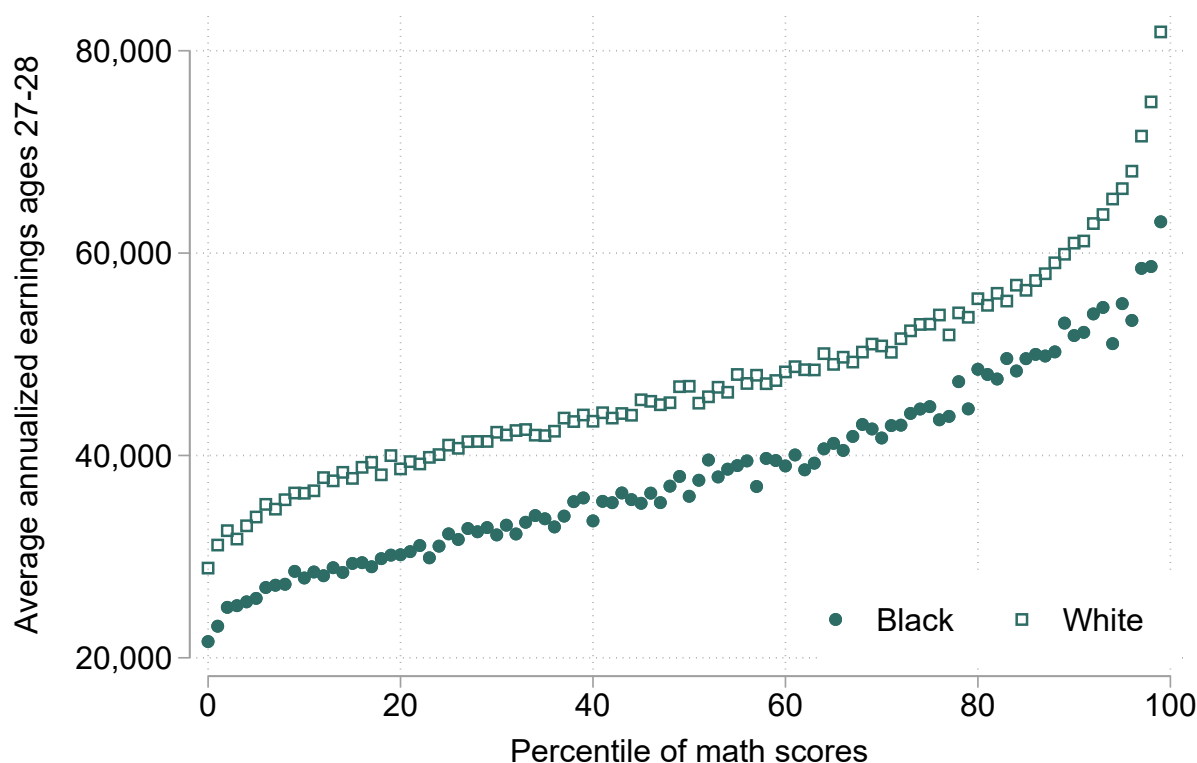
Notes: This figure shows average annualized earnings, for Black or white students, in each percentile of the math test-score distribution. Earnings include only those earned (and reported) in Texas. Percentiles are based on all test takers in Texas public schools, regardless of race or ethnicity, and percentiles are generated from z-scores (standardized within grade and cohort) averaged across all grades in which tests are mandated. The data come from the Texas Education Research Center, using birth cohorts 1986 through 1991.

distribution, where rates of unemployment, regardless of race, are highest.[11]

The earnings gap in Figure 4 is so large that, over a career, it is roughly equal to the current wealth gap between Black and white families in the United States. Extrapolating an annual gap of $10,000 across all prime working ages (25 through 64) with a typical interest rate (three percent) amounts to a deficit of approximately $230,000. A recent estimate by the Brookings Institute using the Federal Reserve's Survey of Consumer Finances places the racial wealth gap in 2021 at $240,000 (Aladangady, Chang and Krimmel, 2023). Indeed, if Black students earned the same wages as white students with the same test scores, they could close the racial

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[11] Further detail on the intensive versus extensive margin is available upon request.

wealth gap by typical retirement age.

These findings contribute to a contentious literature on whether skills cultivated in child-hood (and elicited on tests) can explain racial disparities in labor-market outcomes in adult-hood (e.g., Neal and Johnson, 1996; Darity and Mason, 1998; Heckman, 1998; Carneiro, Heck-man and Masterov, 2005; Cascio and Lewis, 2006). Much of this literature can be traced to Neal and Johnson (1996), which shows that AFQT scores, without controlling for any other variables, can account almost fully for the Black-white wage gap observed in the National Longitudinal Survey of Youth of 1979, or NLSY79. Other studies have found similar results, leading to the conclusion that conditions in early life, rather than discrimination within la-bor markets, are the roots of the Black-white earnings gap in modern times (Heckman, 1998; Fryer, 2011). The idea is that labor markets are rewarding skills equally, but that Black peo-ple, raised in less favorable environments, have fewer of those skills. In our result, which also controls only for a test score, a glaring disparity in earnings remains, approximately 60 percent of the overall gap. This is more consistent with the idea that labor markets involve a significant degree of racial discrimination (Lang and Manove, 2011; Rodgers, Spriggs and Waaler, 1997; Darity and Mason, 1998).

Of course, the standardized test scores we study in this paper and the AFQT scores ex-amined by Neal and Johnson (1996) are not the same object. They may capture different skills that have distinct implications for earnings potential. There is, however, evidence that standardized tests have high correlations with AFQT (Penn Wharton Budget Model, 2021). No existing data source can provide a correlation between the specific test scores we study and AFQT scores, but the available descriptions of the tests suggest significant overlap. The United States Air Force, although terse, describes the two mathematical components of the AFQT as "mathematical concepts and applications" and "basic arithmetic word problems" (ASVAB Career Exploration Program, 2023). The Texas Education Agency's lists as its first purpose of the current standardized testing regime in mathematics to "apply mathematics to problems arising in everyday life, society, and the workplace" Texas Education Agency (2014). Its exams include many basic arithmetic word problems. More concretely, the ex-

planatory power of these scores is noteworthy. If our measure of achievement explained much more of the variation in earnings than AFQT scores explained, one may worry that our measure captures something beyond skills, such as family resources, and those additional factors could explain the discrepancies we find. In our sample, however, the fraction of the variation in earnings that is explained by test scores is roughly eight percent. The analogous number for AFQT scores, using the NLSY79 (or its more modern iteration, the NLSY97), is also eight percent.

Again, it is possible that Black and white students *in the same school* fare similarly conditional on test scores. In Appendix Figure A4, we show that this is again not the case, although the disparity does narrow significantly for all percentiles. After imposing high school fixed effects (in the same fashion as previous outcomes), a gap that was about $10,000 at each rank falls to about $6,000. Notably though, it notably remains around $10,000 at the very top of the distribution of achievement seemingly due to an acceleration in earnings among white students that is not matched by Black students.[12]

Masked in Figure 4 (and Appendix Figure A4), however, is a glaring difference between men and women, a difference that is not seen in the other outcomes we study.[13] The earnings gap (conditional on achievement) observed when pooling sexes is driven almost entirely by the difference between Black and white men. We show this in Figure 5. Men, in Panel A, show a gap of about $15,000 annually at most percentiles, while women, in Panel B, show a much smaller (although still large) gap closer to $5,000. Although not shown, the gap for women fully closes when we look within schools. The gaps falls but remains at about $10,000 for men from the same high school. This difference suggests that mechanisms like racial discrimination or intergenerational wealth require nuance. Explanations invoking them should further specify manifest much more strongly for men. Such pathways are certainly available, but the heterogeneity by sex does rule out many candidates.

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[12] Future versions of this paper will include a formal Gelbach (2016) decomposition of these disparities, though the fact that 60 percent of the gap remains, even after comparing students in the same school, is noteworthy regardless.

[13] Other outcomes by gender are presented in Appendix Figure A9.

Figure 5: EARNINGS CONDITIONAL ON ACHIEVEMENT BY SEX
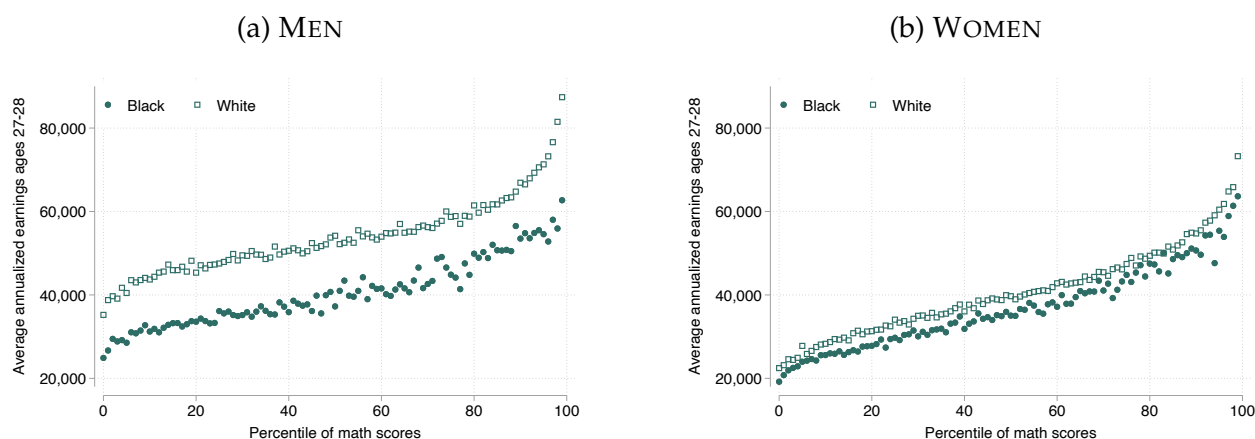
(a) MEN

(b) WOMEN

Notes: This figure shows the rank of average annualized earnings, for Black or white students, in each percentile of the math test-score distribution. Panels A and B show men and women, respectively. Earnings include only those earned (and reported) in Texas. Percentiles of test scores are based on all test takers in Texas public schools, regardless of race or ethnicity, and percentiles are generated from z-scores (standardized within grade and cohort) averaged across all grades in which tests are mandated. The data come from the Texas Education Research Center, using birth cohorts 1986 through 1991.

The fact that men experience much larger earnings gaps (conditional on test scores) than women, for instance, raises questions of criminal justice involvement and single parenthood, which affect men more than women.[14] Accordingly, we linked administrative conviction data and vital records from Texas into the existing data infrastructure to provide measures each. Namely, we construct a simple indicator ever being convicted of a crime in Texas and an indicator for a child's birth record not reporting a father.[15]

In Figure 6, we restrict our samples to male students who were never convicted of a crime (Panel A) and those who had a father indicated on their birth record (Panel B).[16] In both cases,
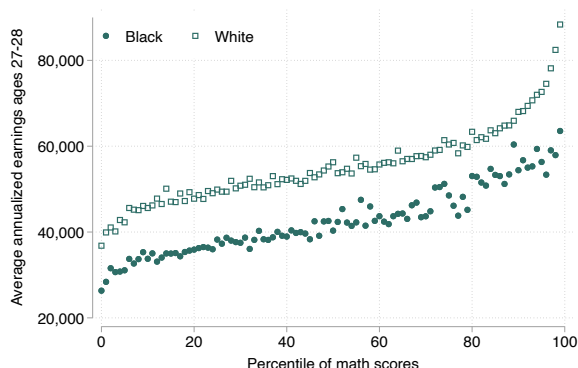
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[14] While the former question is obvious, the clearest example of the latter comes perhaps from (Chetty et al., 2020)

[15] This measure of single parenthood is of course quite crude. No administrative data elicit that status directly, but we believe it serves at least as a useful signal. Our rate of single parenthood, for both Black and white students, is only a few percentage points higher than what would be derived from the ACS.

[16] It should be noted that our measure of conviction includes only those that occur in Texas, but, given that we already restrict attention to people employed in Texas, we are likely capturing a large majority of the convictions within our sample.

Figure 6: Earnings Conditional on Achievement for Select Men

(a) Men never convicted of a crime | (b) Men with a father on birth certificate
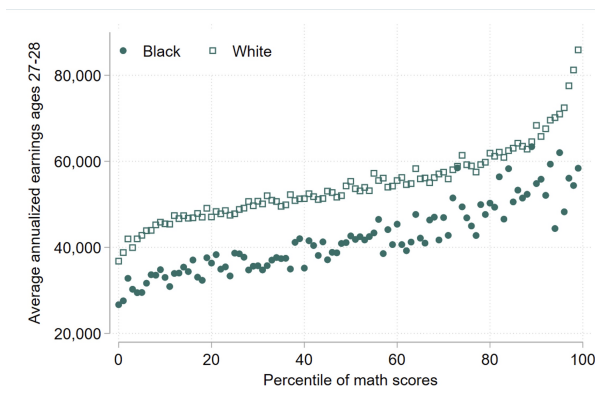

Notes: This figure shows the rank of average annualized earnings, for Black or white students, men only, in each percentile of the math test-score distribution. Panel A restricts the sample to men who were never convicted of a crime (i.e., were never located in administrative conviction data from the Texas Department of Public Safety that was linked in with personal identifiers); Panel B restricts the sample to men who appear to have a father present (i.e., who have a father listed on their birth certificate, which is taken from the publicly available Texas Birth Index and linked in using personal identifiers). Earnings include only those earned (and reported) in Texas. Percentiles of test scores are based on all test takers in Texas public schools, regardless of race or ethnicity, and percentiles are generated from z-scores (standardized within grade and cohort) averaged across all grades in which tests are mandated. The (internal) data come from the Texas Education Research Center, using birth cohorts 1986 through 1991.

the gap is little changed.[17] That is, neither criminal justice involvement nor single parenthood appear to have the capacity to explain much of the disparity in male earnings. This is true despite the fact that, in our sample of men, 20 percent of Black students (and 12 percent of white students) eventually face a conviction and 55 percent of Black students (and 16 percent of white students) appear to be fatherless at the time of their birth.[18]

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[17] This holds whether we compare across or within schools.

[18] In Appendix Figure A5, we plot criminal justice outcomes by achievement. Despite having little effect on the earnings gap (as in Panel A of 6), racial gaps in conviction and incarceration exist across the test-score distribution. Comparing outcomes within schools widens these gaps, particularly among high achieving students.

Figure 7: ABSENCES CONDITIONAL ON ACHIEVEMENT
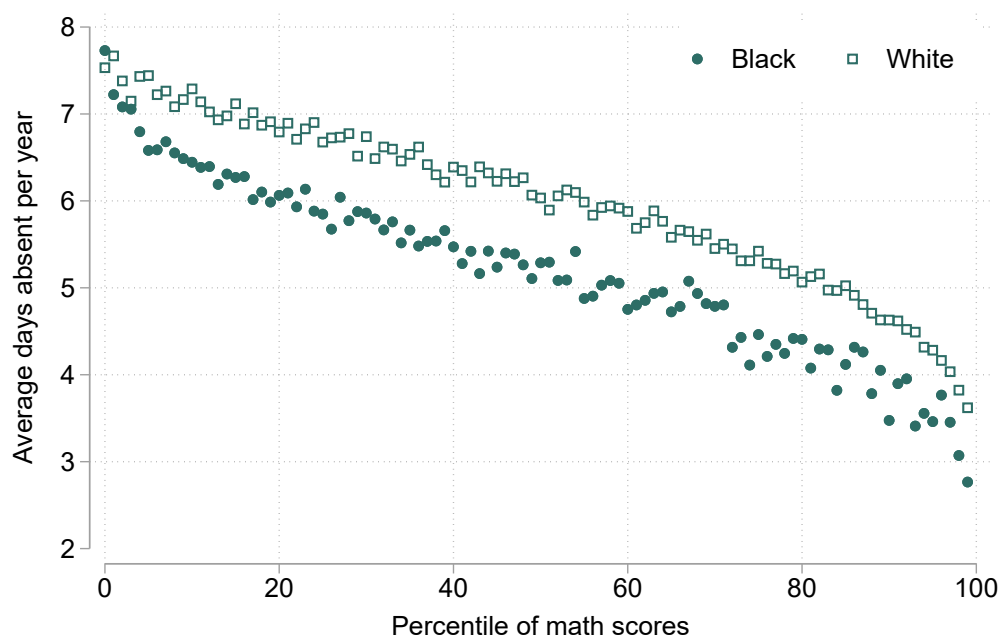
Notes: This figure summarizes absence and discipline, for Black and white students, in each percentile of the math test-score distribution. Panel A plots average absences per school year; Panel B plots average days of disciplinary action assigned per school year. Percentiles are based on all test takers in Texas public schools, regardless of race or ethnicity, and percentiles are generated from z-scores (standardized within grade and cohort) averaged across all grades in which tests are mandated. The data come from the Texas Education Research Center, using birth cohorts 1986 through 1991.

Absences

One reasonable explanation for all of our findings—the evidence that Black students do worse in many respects than white students with the same test scores—is that Black students, at any given level of achievement, experience disadvantages that white students do not. They may have less household wealth or poorer personal health, two things that we cannot observe in our data but are true on average. If one believes that such unobserved differences "explained" our findings, then one may expect to see differences in other measures of student welfare. One might hypothesize, for example, that Black students are more likely than similarly achieving white students to be absent from school, a widely accepted measure of non-cognitive skills. In Figure 7, our final figure, we show that the opposite is true.

As shown in Figure 7, in nearly every percentile of achievement, Black students are significantly less likely than white students to be absent from school. Thus, on a crude but useful signal of latent distress, Black students are actually doing better than their white counterparts. This suggests that, conditional on test scores, Black students fare worse not because their unobserved backgrounds are less favorable. They fare worse despite some factors appearing more favorable. In fact, these findings are consistent with the notion of racial bias in standardized testing. One interpretation is that Black students must do more than white students to reach the same level of achievement. In that sense, comparing Black and white students with the same test scores inherently holds Black students to a higher standard, as they have to overcome unfairness in the medium. Indeed, to the extent that standardized tests are racially biased, the racial disparities between students with identical achievement are even larger than they appear.

Discussion

In an insightful review of both the history and the future of racial inequality in the United States, Fryer (2011) writes, "Closing the racial achievement gap is the most important civil rights battle of the 21st Century." This paper brings to bear detailed administrative data on hundreds of thousands of Black and white Americans who grew up around the turn of the 21st Century. Studying their outcomes as we do reveals new details relevant to the pursuit of closing the racial achievement gap.

We first highlight what a sizable gap there is to close. For all that has been written on achievement, a perhaps underappreciated point is the degree to which Black students are heavily concentrated at the lowest levels of achievement and virtually absent from the highest levels. This implies enormous racial inequality in the tails of children's skill levels. As socioeconomic opportunity in the United States becomes increasingly confined to the highest skill levels, the need to not only close the achievement gap but to elevate Black students to the top of the achievement distribution becomes increasingly urgent. At the same time, as

opportunities for the least skilled Americans appear to be eroding, the need to prevent so many Black students from being at the bottom of the ranks becomes critical.

The lack of progress to date in raising the achievement of Black children suggests that the downstream racial disparities in educational attainment, in income, in wealth, and all the opportunities that those things afford will continue well into the middle of the 21st Century. Encouragingly, as Fryer (2011) notes, there is no natural reason for the Black-white achievement gap to exist. There is no sound empirical evidence to support any claim of genetic differences in the skill capacities of Black and white people, and tests of mental function that are administered as early as cognition can reasonably be measured show virtually no difference between Black and white infants (Fryer and Levitt, 2013). Perhaps most importantly, although far from all, multiple interventions have succeeded in raising the achievement of Black students Fryer (2011).

We then demonstrate several promising pathways for further reducing the Black-white achievement gap and other manifestations of systemic racism. We show that that Black students are far less likely than white students with the same test scores to be enrolled in gifted and special education programs. This provides a clear example of how to increase skills in the tails of the distribution. We show that Black students with low test scores are at elevated risk of dropping out of high school and that Black students, at any point in the skill distribution, are more likely to attempt a college degree but nonetheless less likely to complete it. These facts give policymakers and administrators scope for narrowing the racial disparity in educational attainment. We also show that a vast earnings gap remains, even among Black and white students with the same level of achievement.

Our findings suggests that closing the achievement gap, despite its immense good, may not be sufficient to solve certain racial disparities. Efforts to close the achievement gap, however, may well indirectly close the other sources of inequality, possibly generation over generation. But, whether closing the achievement gap is a key part or the entirety of the battle, continued study of the remarkable data that enabled the incremental research here will surely provide valuable guidance as efforts to erase racial inequality the United States unfold.
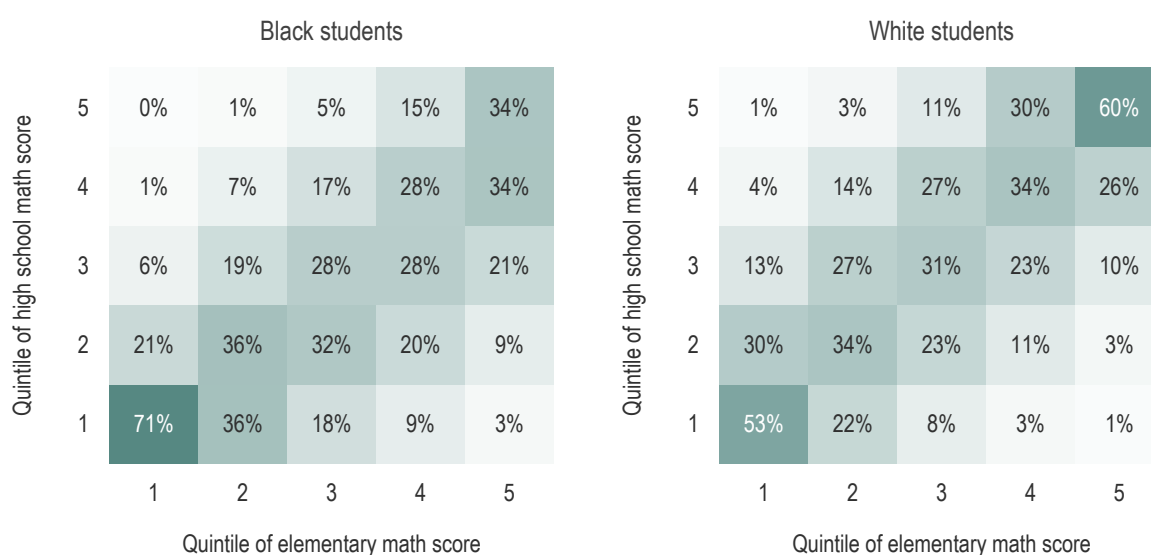
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Appendix

## Figure A1: PERSISTENCE OF ELEMENTARY MATH SCORES BY RACE

Black students

Quintile of high school math score	1	2	3	4	5
5	0%	1%	5%	15%	34%
4	1%	7%	17%	28%	34%
3	6%	19%	28%	28%	21%
2	21%	36%	32%	20%	9%
1	71%	36%	18%	9%	3%

Quintile of elementary math score

White students

Quintile of high school math score	1	2	3	4	5
5	1%	3%	11%	30%	60%
4	4%	14%	27%	34%	26%
3	13%	27%	31%	23%	10%
2	30%	34%	23%	11%	3%
1	53%	22%	8%	3%	1%

Quintile of elementary math score

Notes: This figure shows persistence of elementary math scores by race. All columns add up to 100%, and each cell's value indicates the percentage of students from within an elementary math quintile that achieved in the designated high-school math quintile. Darker colors indicate a higher percentage of students in a given cell. The data come from the Texas Education Research Center, using birth cohorts 1986 through 1991.

Figure A2: Tailored Instruction Conditional on Achievement, Within-school Comparison
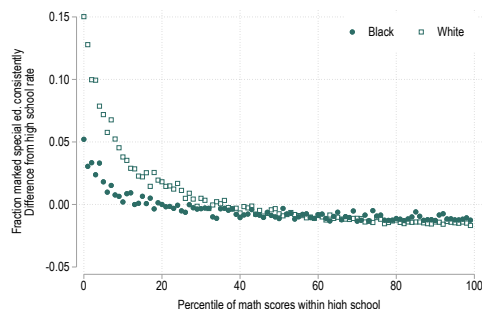
(a) Enrolled in a gifted program at least once
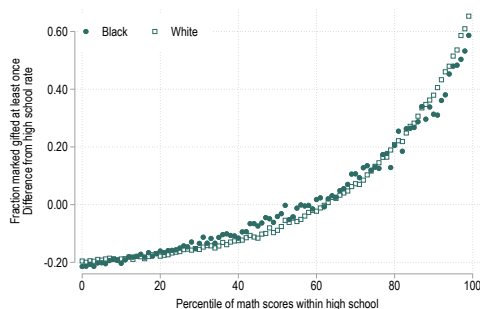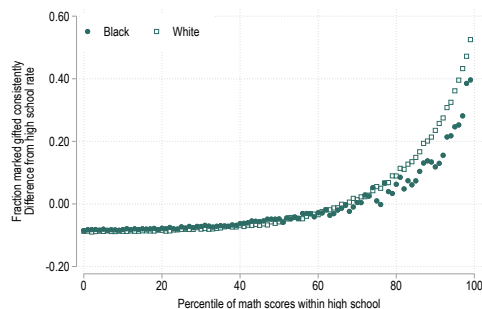
(b) Enrolled in a gifted program many years

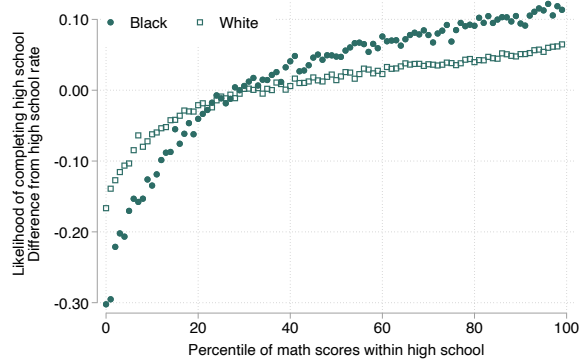(c) Enrolled in special education at least once
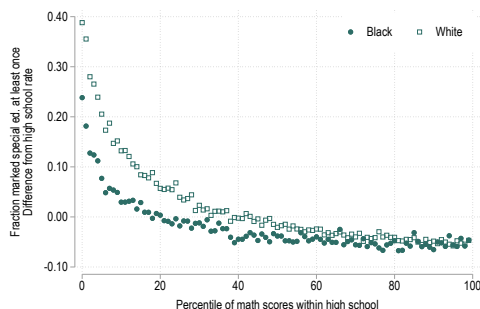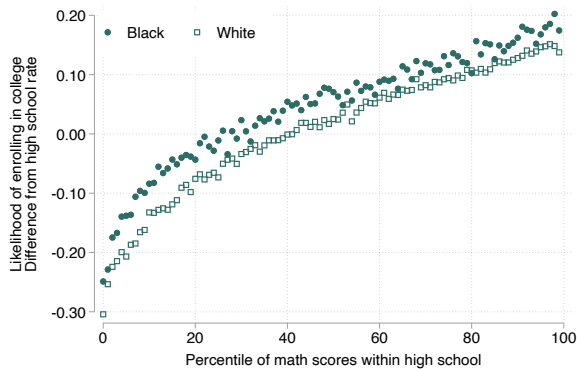

(d) Enrolled in special education many years

Notes: This figure shows the likelihood of students, Black or White, in each percentile of their high school's math test-score distribution to receive tailored instruction. Panel A plots the likelihood of enrollment in a gifted program in any grade level relative to their high school's overall rate (i.e., de-meaned); Panel B plots the likelihood of enrollment in gifted programs in at least half of the grade levels between 3rd grade (when standardized testing in math begins) and 12th grade, again de-meaned within high school. Panels C and D do the same for special education. Percentiles are based only on test takers in the same high school but include all races and ethnicities therein (i.e., overall high school rank in test scores). Percentiles are generated from z-scores (standardized within grade and cohort) averaged across all grades in which tests are mandated. The data come from the Texas Education Research Center, using birth cohorts 1986 through 1991.

Figure A3: EDUCATIONAL ATTAINMENT CONDITIONAL ON ACHIEVEMENT, WITHIN-SCHOOL COMPARISON
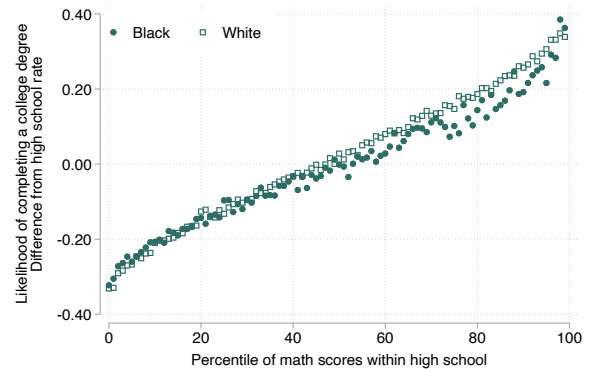
(a) LIKELIHOOD OF COMPLETING HIGH SCHOOL

### (b) LIKELIHOOD OF EVER ENROLLING IN COLLEGE

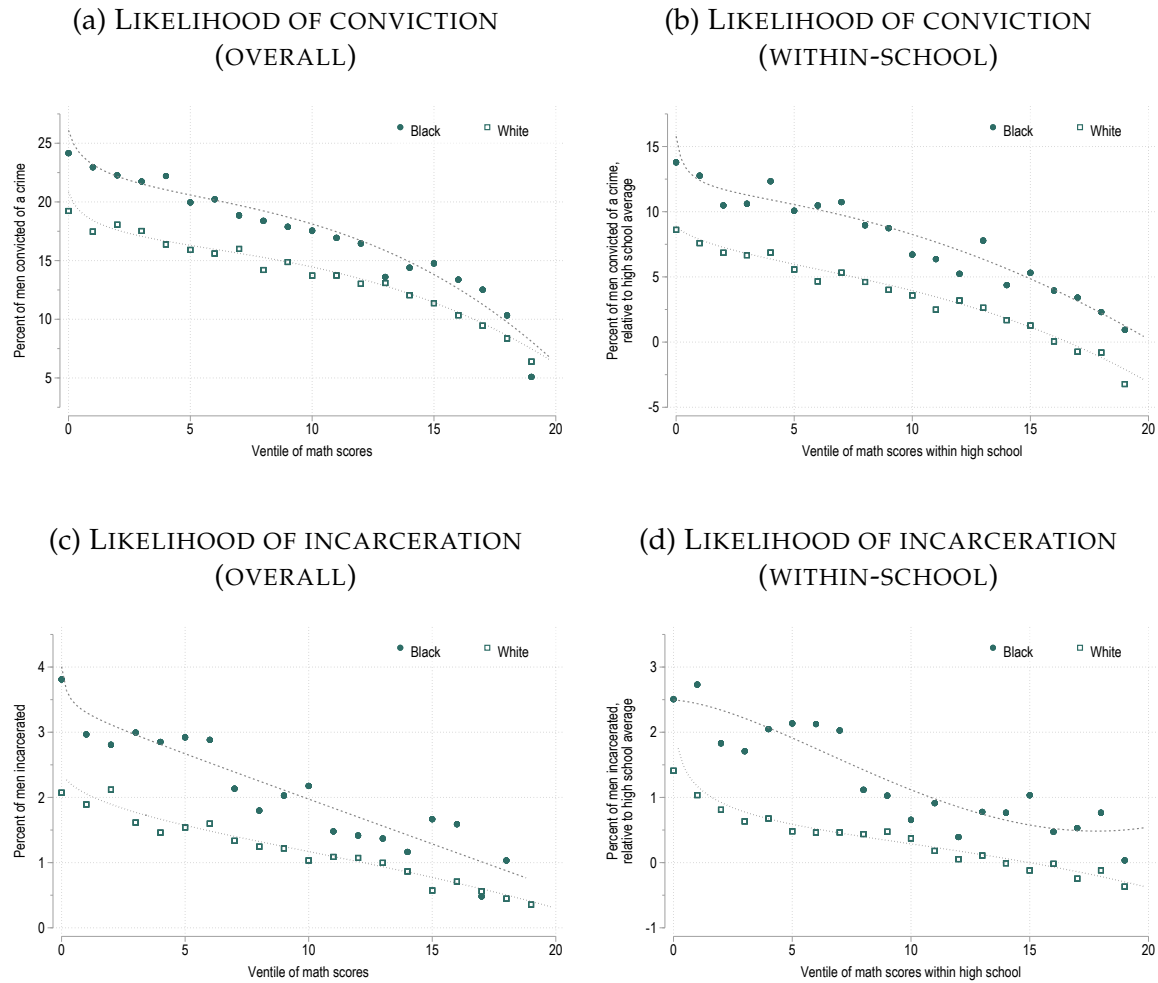### (c) LIKELIHOOD OF COMPLETING A COLLEGE DEGREE

Notes: This figure shows the likelihood of students, Black or White, in each percentile of their high school's math test-score distribution reaching a certain level of education. Panel A plots the likelihood of completing high school relative to their high school's overall rate (i.e., de-meaned); Panel B, attending some college, de-meaned; Panel C, completing a college degree, de-meaned. Percentiles are based only on test takers in the same high school but include all races and ethnicities therein (i.e., overall high school rank in test scores). Percentiles are generated from z-scores (standardized within grade and cohort) averaged across all grades in which tests are mandated. The data come from the Texas Education Research Center, using birth cohorts 1986 through 1991.

Figure A4: Earnings Conditional on Achievement, Within-school Comparison
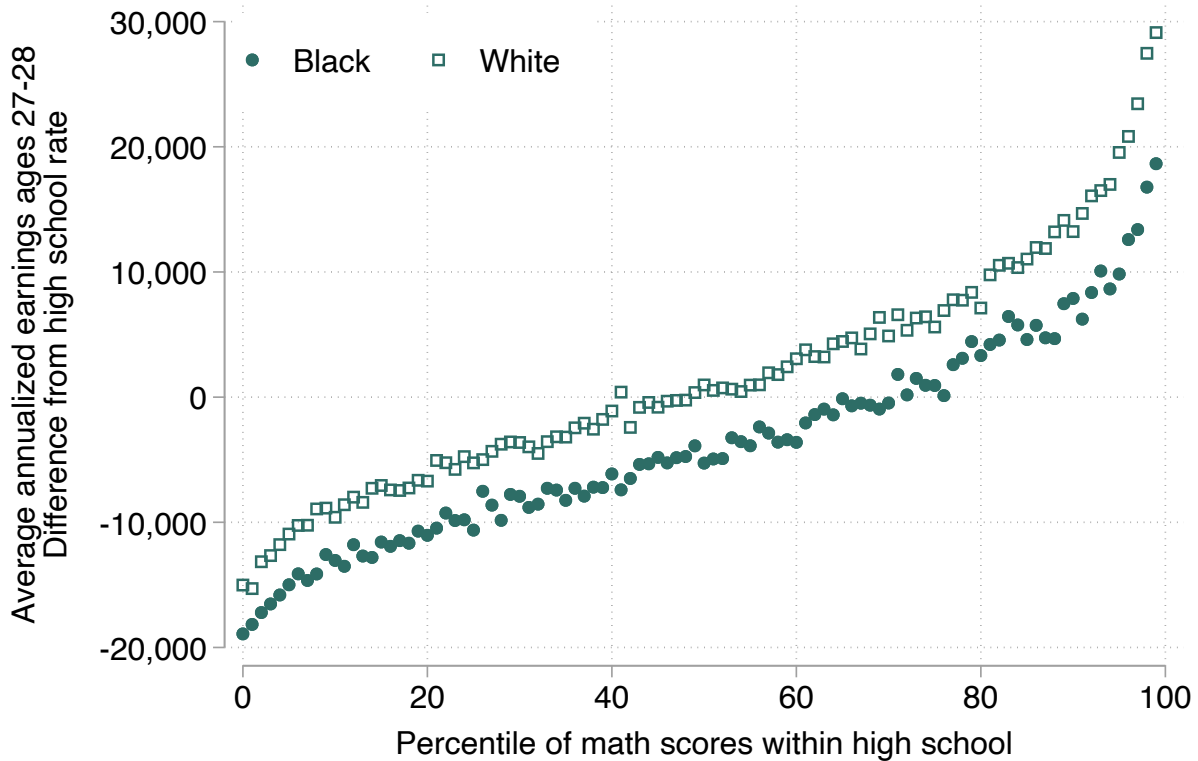

Notes: This figure shows average annualized earnings, for Black or White students, in each percentile of their high school's math test-score distribution. Earnings shown are relative to their high school's average earnings (i.e., de-meaned). Earnings include only those earned (and reported) in Texas. Percentiles are based only on test takers in the same high school but include all races and ethnicities therein (i.e., overall high school rank in test scores). Percentiles are generated from z-scores (standardized within grade and cohort) averaged across all grades in which tests are mandated. The data come from the Texas Education Research Center, using birth cohorts 1986 through 1991.

Figure A5: CRIMINAL JUSTICE OUTCOMES CONDITIONAL ON ACHIEVEMENT (MEN ONLY)

(a) LIKELIHOOD OF CONVICTION
(OVERALL)

(b) LIKELIHOOD OF CONVICTION
(WITHIN-SCHOOL)

(c) LIKELIHOOD OF INCARCERATION
(OVERALL)

(d) LIKELIHOOD OF INCARCERATION
(WITHIN-SCHOOL)

Notes: This figure shows average criminal justice outcomes, for Black or white male students, by their place in the math score distribution. Lines display fractional polynomials fit for each group, based on the underlying percentile data. The top row displays the conviction rate–defined as whether an individual in Texas was ever found to be convicted of a misdemeanor or felony–while the bottom row displays the rate of individuals ever incarcerated in Texas. The left column compares overall test scores to overall criminal justice outcomes rates, while the right compares outcome rates and test scores relative to the high school average. See notes to other figures for construction of test-score averages. Data come from the Texas Education Research Center and Texas Department of Public Safety, using birth cohorts 1986 through 1991.

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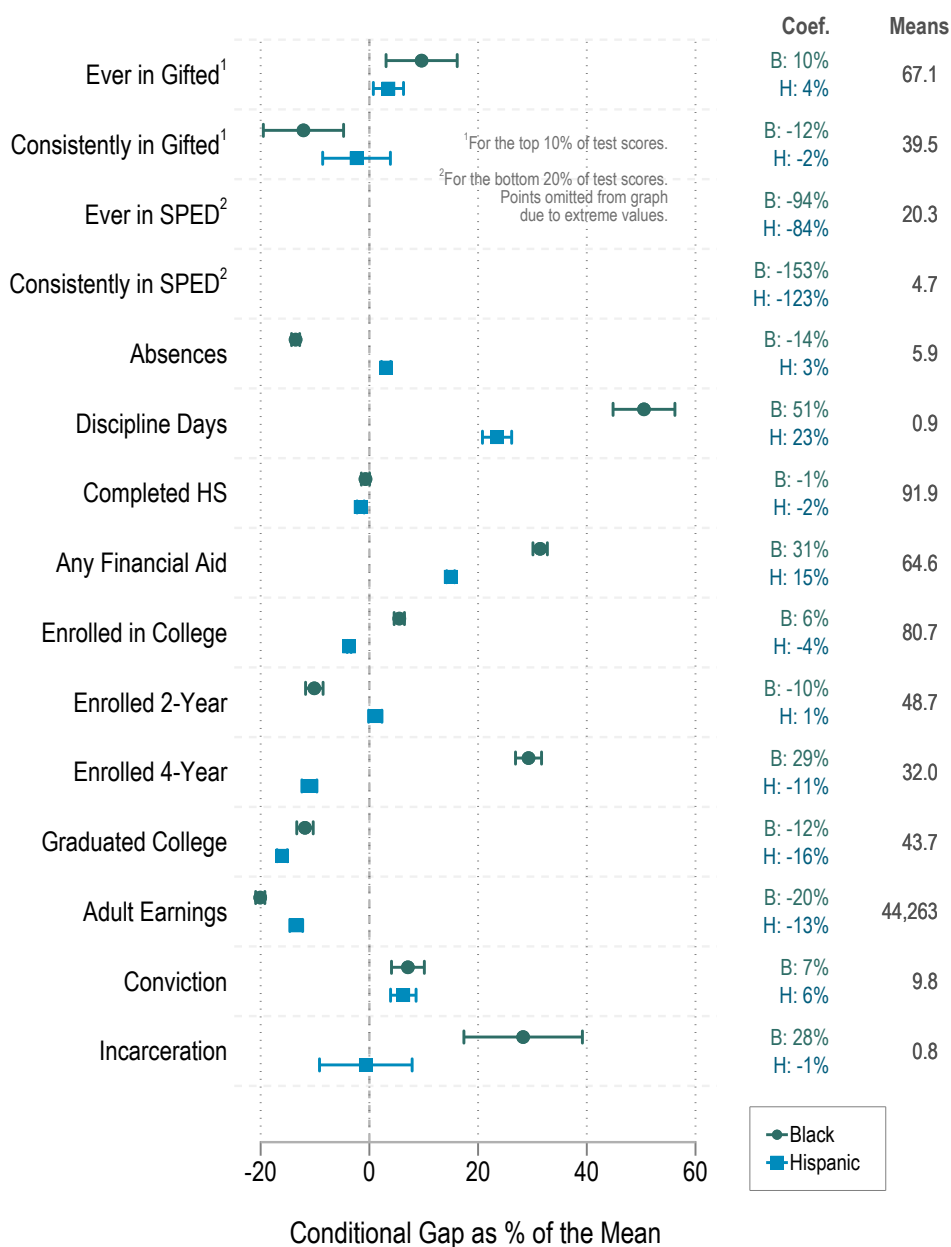Figure A6: COMPARISON OF CONDITIONAL BLACK-WHITE GAP: OVERALL AND WITHIN SCHOOLS
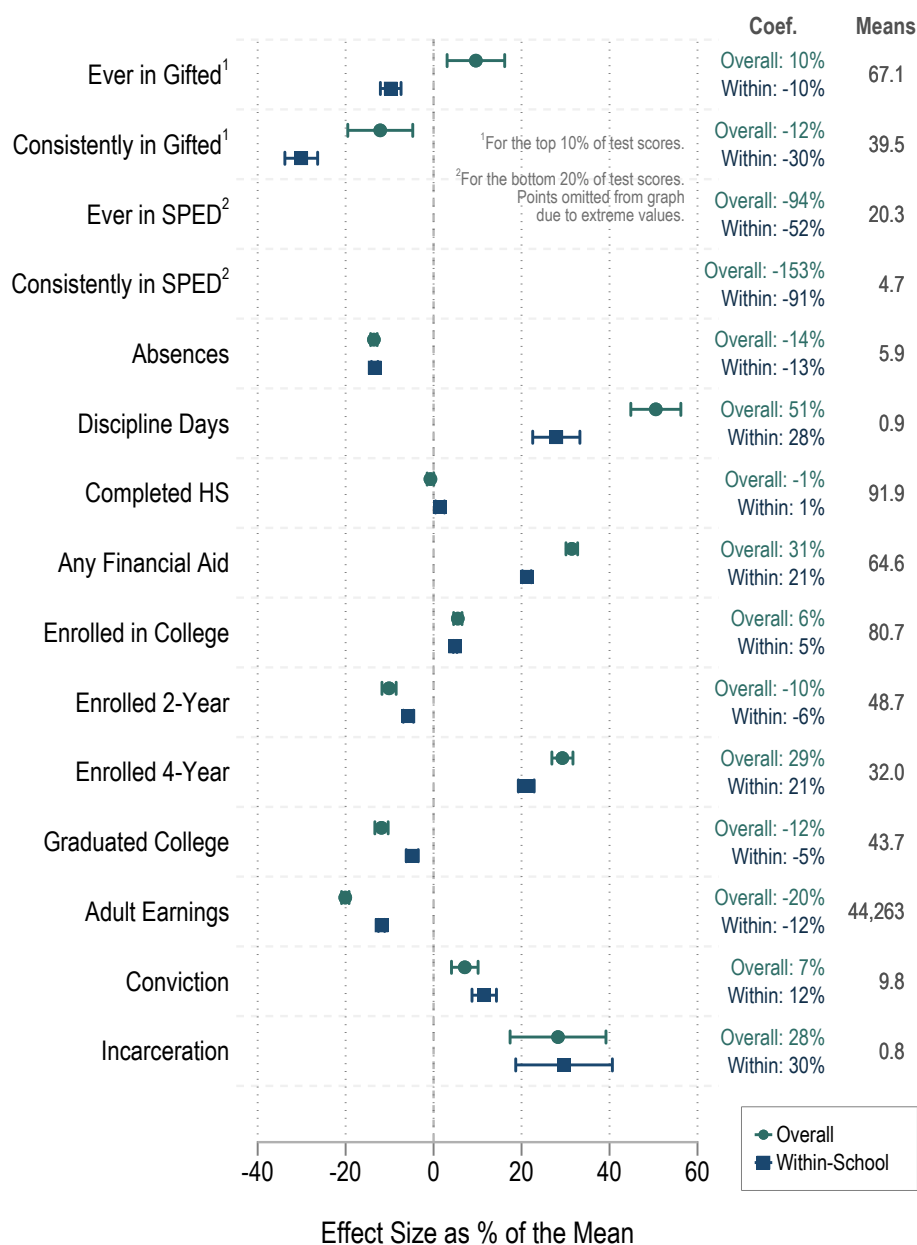
Notes: This figure shows the average conditional score gaps for black students relative to white students. Estimates for "Overall" and "Within-School" come from separate regressions, with an indicator for race and fixed effects for each score percentile. Outcomes for within-school regressions have been recentered around the high school mean, analogous to including school fixed effects in the regression. The data come from the Texas Education Research Center, using birth cohorts 1986 through 1991.

Figure A7: COMPARISON OF CONDITIONAL BLACK-WHITE GAP: CONDITIONAL ON FULL SET OF SCORES VS. ELEMENTARY-ONLY SCORES
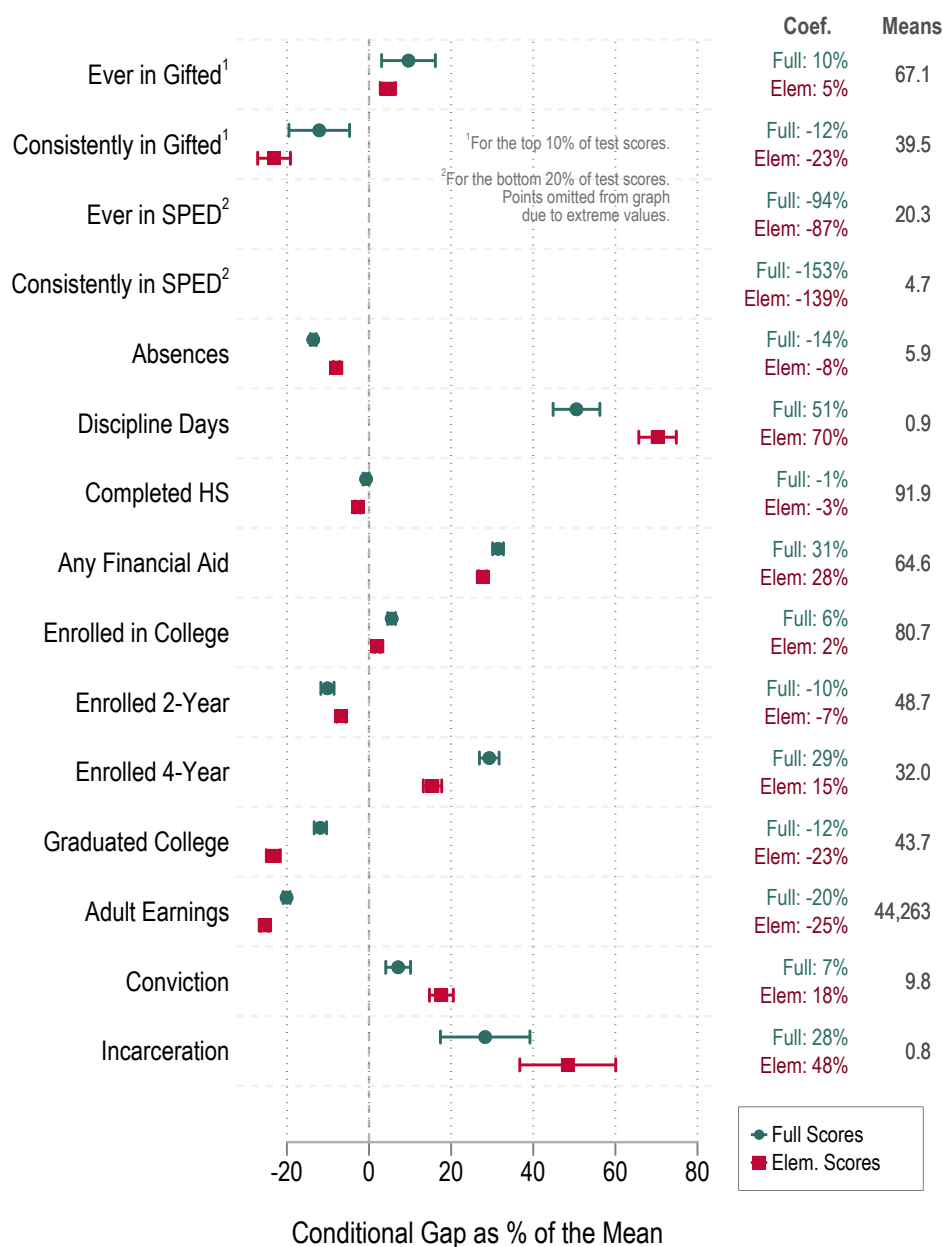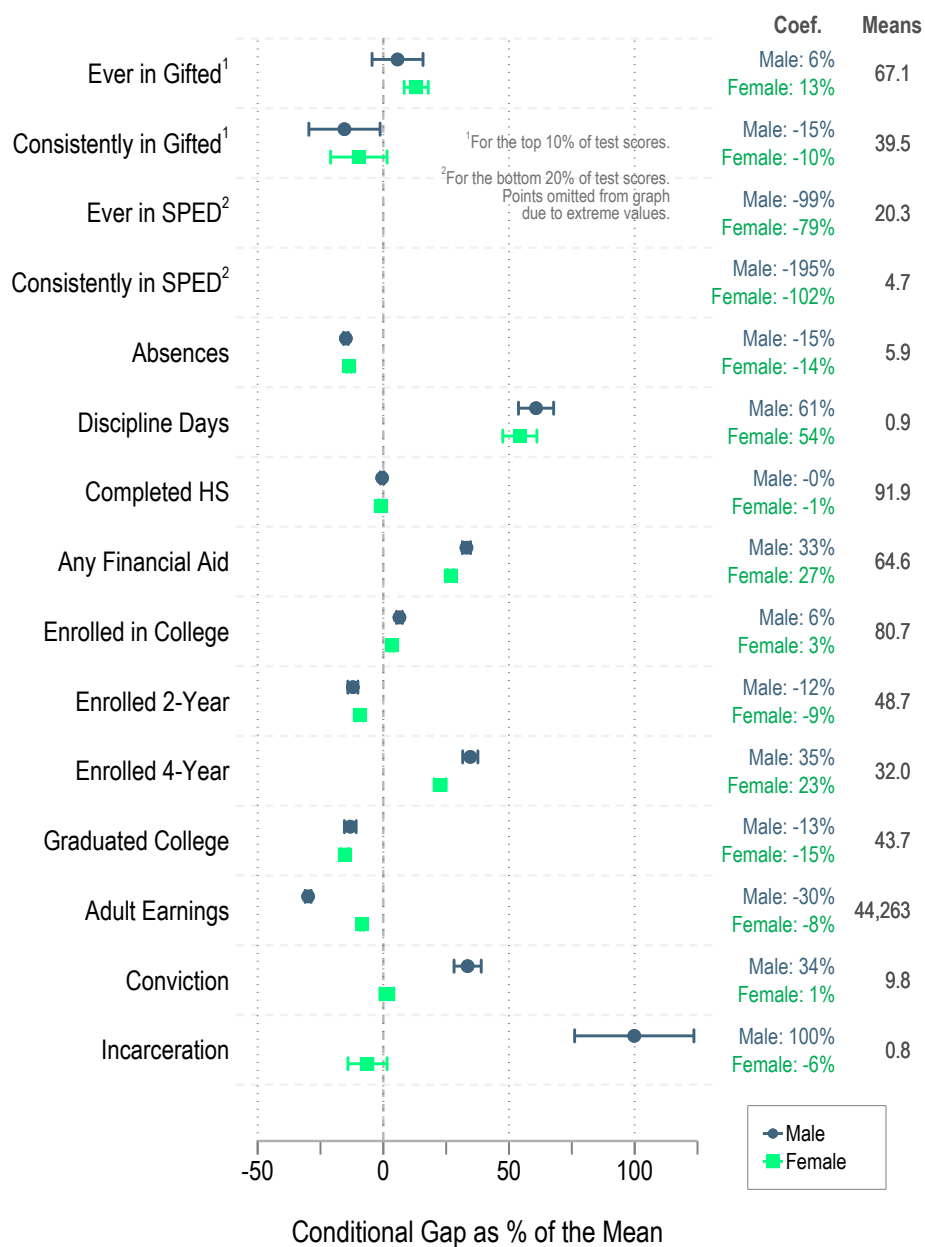
Notes: This figure shows the average conditional score gaps for black students relative to white students. Estimates for "Full Scores" and "Elementary Scores" come from separate regressions, with an indicator for race and fixed effects for each score percentile. Score percentiles are either defined using an average of scores across elementary, middle, and high school ("Full Scores") or elementary school only. The data come from the Texas Education Research Center, using birth cohorts 1986 through 1991.

Figure A8: COMPARISON OF CONDITIONAL BLACK-WHITE GAP AND CONDITIONAL HISPANIC-WHITE GAP

Notes: This figure shows the average conditional score gaps, relative to white students. Estimates for Black and Hispanic students come from separate regressions, with an indicator for race/ethnicity and fixed effects for each score percentile. The data come from the Texas Education Research Center, using birth cohorts 1986 through 1991.

Figure A9: COMPARISON OF CONDITIONAL BLACK-WHITE GAP: MALE VS. FEMALE

Notes: This figure shows the average conditional score gaps for black students relative to white students. Estimates for "Male" and "Female" come from separate regressions, with an indicator for race and fixed effects for each score percentile. Thus, the estimates estimate the *relative* Black-white gap for each gender, and not the unconditional gender gap. The data come from the Texas Education Research Center, using birth cohorts 1986 through 1991.